

1987 GYPSY MOTH INTEGRATED PEST
MANAGEMENT PROGRAM ACTIVITIES

CATOCTIN MOUNTAIN PARK
Thurmont, Maryland

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BACKGROUND

In 1986 an intensive gypsy moth monitoring/IPM program was initiated at Catoclin Mountain Park. The objective of the program was to intensify monitoring efforts at CMP in order to track gypsy moth population build-up and to initiate and evaluate tactics that show promise in low level population management prior to the occurrence of wide spread defoliation.

As a result of the 1986 program activities (Schneeberger et al 1987) an administrative decision was made to aerially treat two selected areas using microbial insecticides within CMP. In addition, a non-insecticide intervention strategy would be evaluated using pheromone-impregnated tape (Luretape) in an effort to disrupt mating and maintain low level gypsy moth populations in selected areas elsewhere in the Park.

INTERVENTION ACTIVITIES

SUPPRESSION PROJECT

In 1987, two spray blocks consisting of approximately 1920 acres was identified and treated with a single application of Bacillus thuringiensis (Figure 1.). The first treatment area consisted of approximately 1300 acres, encompassing the eastern portion of the Park. The second treatment block consisted of approximately 620 acres which included the Naval Support Facility (Camp David) and the horse trail behind the facility.

On May 11, 1987, the first treatment block was treated by the Maryland Department of Agriculture with a single application of Bt at the rate of 12 BIU in 128 oz/acre total formulation. Four days later on May 15, 1987, the Naval Support Facility block was treated by Helicopter Applicators with a single application of Bt at the above rate. A summary of the suppression activities is available (Schneeberger 1987). Table 1 compares the pre- and post-treatment egg mass counts within the treatment areas. A summary of the post-treatment egg mass survey results is available (see Gypsy Moth Egg Mass Survey Report, 12/18/87).

DISPARLURE TREATMENT EVALUATION

In April of 1987, three 32 acre study plots were identified for the deployment of luretape (Figure 2). The plots were established in areas comprised of predominantly oak and resident gypsy moth populations were estimated to be relatively low based on the 1986 grid point egg mass survey data. Once established, each study plot was intensively surveyed using thirty randomly distributed 1/40th acre fixed radius plots to more accurately describe resident gypsy moth populations. A total of 10 burlap bands was also deployed on host trees within each plot to monitor larval activity. The results are listed in Table 2. Within each plot, plastic disparlure disruptant dispensers impregnated with 249 mg disparlure per 1.5 x 2 inch dispenser was deployed at 10 meter intervals at the rate of approximately 20 grams per acre.

In February 1988, post-treatment egg mass counts, were conducted at the same intensity following the same established procedure. A comparison of pre- and post-treatment egg mass counts are listed in Table 3. Also in February, a total of 15 egg masses was collected from each plot and 15 egg masses from outside the treatment areas to determine the relative success of mating.

The feritility aspect of this evaluation was determined by incubating the collected egg masses at the Morgantown Entomological Laboratory for larval emergence. The egg masses were placed in petri dishes and kept under optimum conditions (approximately 75-80 degrees farenheit and 50-55 percent RH) to stimulate hatch. Once larvae emerged, the egg mass was considered to have been successfully fertilized. Of the 45 egg masses reared, only one failed to hatch. An examination of the eggs revealed no larval development had occurred, indicating the lack of fertilization. Hatch occurred in 80 percent of the egg masses sometime between day 14 and 16 and 98 percent were hatching within 18 days of incubation.

DETECTION ACTIVITIES--1987

Defoliation Survey

Approximately 24 acres of heavy defoliation (61-100%) and 24 acres of moderate defoliation (31-60%) occurred at CMP this past summer (Figure 3). The majority of the defoliation occurred within the spray block in the southeastern section of the Park. The defoliation survey results were obtained by conventional aerial sketchmapping techniques on June 23, 1987, and from interpretation of high altitude color infrared imagery taken on or about June 18, 1987.

MONITORING ACTIVITIES--1987

In 1987, an additional 17 grid point locations were added to the grid system that was established in 1986. These additional grid points help fill in holes left by the original grid systems and will provide better coverage of the Park. With the addition of these plots, there is now a total of 89 grid point locations at CMP.

Larval and Pupal Monitoring

In addition to the larvae and pupae observations made within the lure tape plots (Table 2), monitoring of larvae and pupae was conducted by banding 5 oak trees (chestnut, black, or white) at selected grid points within the southeastern spray block. The results are presented in Table 4.

Male Moth Trapping

The standard milk carton type trap was again deployed at each grid point at CMP in early June. The traps were checked an average of two times each, the final check was the last week of August. A number of traps were disturbed by small mammals and dermestid beetles so estimates were necessary based upon the number of wings found.

A comparison of the 1986-87 cumulative male moth catch by grid point is presented in Table 5. Figure 4 shows the grid point locations and the number of moths caught. Every trap deployed caught male moths. Catches ranged from a low of 24 to a high to 1906 moths per trap.

Even though all other facets of the monitoring and detection programs show an increase in gypsy moth activity, the average male moth catch per trap decreased 14%. In 1986, the average was 731 compared to 628 in 1987.

Egg Mass Counts

Egg mass surveys were conducted in October of 1987 at all grid point locations following the same procedures used in 1986. Table 6 compares 1986-87 egg mass counts for each of the grid point locations. Figure 5 shows the grid point locations and each of the egg mass counts. Egg mass counts ranged from a low of 0 to a high of 3640 per acre. The average number of egg masses per acre increased 485% from the 1986 level of 33 to the 1987 level of 193. Egg masses were found at 44% of the plots in 1987 compared to 18% in 1986. The percent of plots that have egg mass counts per acre which exceed the commonly used defoliation threshold of 250 has increased from 2 in 1986 to 15 in 1987. For illustration purposes, Figure 6 presents a comparison of the percentage of plots within each egg mass density category for 1986 and 1987. Six of the 13 plots that exceed the 250 egg mass per acre level in 1987 were in the treatment block in the southeastern part of CMP.

A total of 5 five-minute walks were conducted in the Greentop area to facilitate further delineation of gypsy moth populations in this area. Gypsy moth egg mass densities ranged from 56-611 egg masses/acre from the walks and averaged 419 egg masses per acre within the Greentop area (see Gypsy Moth Egg Mass Survey Report, 12/18/87).

Hazard Rating

Another facet of the 1987 IPM activities at CMP involved hazard rating to assess the potential stand defoliation (susceptibility) and mortality (vulnerability) should a heavy infestation occur. At the center of each grid point a 10 BAF variable radius plot was established. All "in" trees had species, diameter, and crown condition recorded.

Each grid point was then rated on a scale of 1 to 3 according to defoliation potential (Herrick and Gansner, 1986). The rating chart uses percent basal area (BA) of all oaks, percent BA of black and chestnut oaks, percent BA in good crown condition, and tree diameter. Potential for light defoliation (less than 20%) was assigned a 1, moderate defoliation (21-29%) a 2, and heavy defoliation (30-100 percent) a 3. Table 7 presents the susceptibility to defoliation by grid point. Of the 78 grid points rated, 54% were susceptible to light defoliation, 31% were susceptible to moderate defoliation, and 15% were susceptible to heavy defoliation.

Stand vulnerability is also rated on a scale of 1-3 for estimating potential tree mortality following defoliation (Gansner and Herrick, 1984). The rating system uses a percent of live trees in the white oak species group and percent of live trees with poor crowns in order to predict mortality. Potential for light mortality (less than 10%) received a 1, moderate mortality (11-25%) a 2, and high mortality (greater than 25%) a 3. Table 8 presents the vulnerability rating by grid point. Sixty-eight percent of the plots were rated as vulnerable to light mortality, 25% were vulnerable to moderate mortality, and 6% were vulnerable to heavy mortality.

DISCUSSION

The primary tasks outlined in the 1987 work plan were accomplished. The grid system was expanded but not in time to be included in the 1987 male moth trapping phase of the program. The need for the expansion was supported by the occurrence of defoliation and high egg mass counts in areas within the Park that were previously not being monitored.

The 1986-87 male moth trap results are a bit misleading when compared against the increase in egg mass densities over last year. One reason may be due to the difference in the number of trap inspections. Since trap efficiency decreases as the trap fills, the two inspections in 1987 may not have been sufficient for comparative purposes with the 1986 data of which three inspections were conducted. To maintain trap efficiency and provide future consistency, we recommend trap inspections be conducted three times during the trapping season.

The results of the egg mass survey data indicates that gypsy moth populations are once again on the rise. The heaviest concentrations exist in the area of Greentop Campground (average 419 egg masses/acre) and again in the eastern portion of the Park located east of Park Central Drive (average 547 egg masses/acre). These areas, in addition to the Naval Facility, are currently being considered for treatment in 1988.

Based on the preliminary results of the disparlure evaluation, it appears as though the treatment had no effect on either reducing the relative success of mating or maintaining gypsy moth egg mass densities at or below pre-treatment levels. Since the disparlure is active for two years, however, further evaluation will be necessary to determine the overall effect.

The hazard rating phase of the 1987 program activities was conducted at the 78 grid points previously established in 1986. The addition of the 17 grid points established in 1987 came too late in the season to be incorporated. These points will be evaluated in 1988. Although the collected information will prove useful in point by point evaluations, a more practical approach would be to hazard rate specific areas based on vegetative cover type information. Although sufficient information is lacking at present, a proposed photo mission for Catoctin Mountain Park in 1988 may provide one avenue of approach to collecting the necessary data.

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Table 1.--Pre- and Post-Treatment Egg Mass Counts for B.t. Treatment Blocks at Catoclin Mountain Park, 1987.

Spray Block	Grid Point	Pre-Treatment EM/Acre	Post-Treatment EM/Acre
Eastern Block	J-10	0	0
Eastern Block	J-11	0	0
Eastern Block	J-12	*	160
Eastern Block	K-10	0	0
Eastern Block	K-11	0	40
Eastern Block	K-12	*	320
Eastern Block	K-13	*	1840
Eastern Block	K-14	*	400
Eastern Block	L-10	0	0
Eastern Block	L-11	40	120
Eastern Block	L-12	1080	40
Eastern Block	L-13	*	1680
Eastern Block	L-14	*	2080
Eastern Block	M-10	0	0
Eastern Block	M-11	80	0
Eastern Block	M-12	120	0
Eastern Block	M-13	*	960
Eastern Block	M-14	*	3640
Eastern Block	N-11	40	0
Eastern Block	N-12	0	40
Eastern Block	N-13	520	120
Eastern Block	O-12	*	0
Eastern Block	O-13	*	40
Naval Support Facility	F-7	*	720
Naval Support Facility	F-8	80	80
Naval Support Facility	G-7	0	0
Naval Support Facility	G-8	0	0
Naval Support Facility	H-7	0	0
Naval Support Facility	H-8	0	40
Naval Support Facility	I-6	0	80
Naval Support Facility	I-8	0	0
Naval Support Facility	J-7	80	0

* Point Not Established

Table 2.--Average Number of Larvae/Pupae Observed in Disparlure Treated Plots. Catoclin Mountain Park Integrated Pest Management Program, 1987 Activities.

Date	Sample Site *		
	Block 1	Block 2	Block 3
June 1			
# Larvae	17	7.2	**
# Pupae	0	0	**
June 5			
# Larvae	**	**	24.2
# Pupae	**	**	0
June 10			
# Larvae	52.2	23.3	48.8
# Pupae	0	0	0
June 15			
# Larvae	54.7	16.1	53.2
# Pupae	0	0	0
June 19			
# Larvae	65.0	28.7	59.4
# Pupae	0	0	0
June 25			
# Larvae	56.3	17.1	27.9
# Pupae	16.1	4.5	19.7
June 30			
# Larvae	15.7	9.9	12.7
# Pupae	18.9	14.7	26.0

* Total of ten trees banded in each plot.

** No sample collected.

Table 3.--Pre- and Post-Treatment Egg-Mass Counts in Disparlure Treated
Plots. Catoctin Mountain Park, 1986-87.
1987
87-88

	Pre-treatment (egg masses/acre)	Post-treatment (egg masses/acre)
Plot 1	11 27.5	151 82.1
Plot 2	3 7.5	91 42
Plot 3	21 52.5	196 63.1
Parkwide	33	193 83.1

Table 4.--Average number of Larvae/Pupae observed in B.t. Spray Block. Catoctin Mountain Park Integrated Pest Management Program, 1987 Activities.

Sample Site *						
Date	L-11	L-12	M-11	M-12	N-11	N-12
June 5						
# Larvae	1.2	1.8	0.2	0	1.8	0
# Pupae	0	0	0	0	0	0
June 10						
# Larvae	4	6.8	0	0	5.4	0
# Pupae	0	0	0	0	0	0
June 15						
# Larvae	4	10.8	0.2	0.4	6.6	0.2
# Pupae	0	0	0	0	0	0
June 19						
# Larvae	6.4	11	0.6	0.8	11.2	0.6
# Pupae	0	0	0	0	0	0
June 25						
# Larvae	3.6	11.6	1.2	1.4	11.8	0.2
# Pupae	0.4	1.4	0	0	1.4	0.2
June 30						
# Larvae	3.4	11.2	1.6	0.6	5.8	0.6
# Pupae	0	4.8	0	0	2.8	0.2

* Total of five trees banded at each grid point.

Table 5.--Comparison of 1986 and 1987 Male Moth Catches by Grid Point.
Catoclin Mountain Park Integrated Pest Management Program.

Grid Point	Number of Moths 1986	Number of Moths 1987
C 3	106	145
C 4	247	309
D 2	600	367
D 3	492	742
D 4	315	863
E 1	*	*
E 2	43	430
E 3	1135	1725
E 4	*	*
E 5	1054	37
F 1	775	429
F 2	366	393
F 3	866	41
F 4	788	784
F 5	5	24
F 6	*	*
F 7	*	*
F 8	482	1521
G 2	1892	666
G 3	357	130
G 4	866	1282
G 5	876	1189
G 6	*	*
G 7	221	522
G 8	290	609
H 2	633	337
H 3	429	713
H 4	241	396
H 5	609	347
H 6	*	*
H 7	273	597
H 8	252	512
I 2	490	595
I 3	825	1042
I 4	109	612
I 5	446	1372
I 6	128	258
I 8	234	838
I 9	936	1559
I 10	918	912
I 11	*	*
J 2	446	432
J 3	287	380
J 4	611	1684
J 5	27	418

Table 5.--Comparison of 1986 and 1987 Male Moth Catches by Grid Point.
Catoctin Mountain Park Integrated Pest Management Program (cont.).

Grid Point	Number of Moths 1986	Number of Moths 1987
J 7	339	675
J 8	510	586
J 9	270	536
J 10	437	634
J 11	703	714
J 12	*	*
K 4	1439	1326
K 5	1255	146
K 6	1166	906
K 7	871	672
K 8	935	628
K 9	593	734
K 10	525	339
K 11	1082	646
K 12	*	*
K 13	*	*
K 14	*	*
L 4	892	368
L 5	837	342
L 6	805	606
L 7	1170	803
L 8	931	530
L 9	647	203
L 10	904	318
L 11	310	695
L 12	1857	805
L 13	*	*
L 14	*	*
M 4	1036	575
M 5	798	245
M 6	428	198
M 7	497	139
M 8	454	265
M 9	745	383
M 10	234	183
M 11	1228	528
M 12	1451	602
M 13	*	*
M 14	*	*
N 11	1127	506
N 12	1265	660
N 13	1790	835
O 12	*	*
O 13	*	*

* = Grid point established after 1987 male moth trapping season.

Table 6.--Comparison of 1986 and 1987 Egg Mass Counts by Grid Point.
Catoctin Mountain Park Integrated Pest Management Program.

Grid Point	Number of Egg Masses/Acre 1986	Number of Egg Masses/Acre 1987
C 3	0	0
C 4	0	0
D 2	0	40
D 3	120	560
D 4	0	0
E 1	*	120
E 2	0	0
E 3	0	40
E 4	*	0
E 5	0	80
F 1	0	0
F 2	0	40
F 3	0	0
F 4	80	0
F 5	0	120
F 6	*	40
F 7	*	720
F 8	80	80
G 2	40	0
G 3	0	0
G 4	40	0
G 5	0	0
G 6	*	0
G 7	0	0
G 8	0	0
H 2	0	0
H 3	0	0
H 4	0	0
H 5	0	0
H 6	*	0
H 7	0	0
H 8	0	40
I 2	0	0
I 3	0	0
I 4	0	0
I 5	0	40
I 6	0	80
I 8	0	0
I 9	0	160
I 10	0	40
I 11	*	0
J 2	0	240
J 3	0	80
J 4	0	0
J 5	0	1440

Table 6.--Comparison of 1986 and 1987 Egg Mass Counts by Grid Point.
Catoclin Mountain Park Integrated Pest Management Program (cont.).

Grid Point	Number of Egg Masses/Acre 1986	Number of Egg Masses/Acre 1987
J 7	80	0
J 8	0	160
J 9	0	200
J 10	0	0
J 11	0	0
J 12	*	160
K 4	0	40
K 5	0	440
K 6	0	520
K 7	0	0
K 8	0	0
K 9	0	0
K 10	0	0
K 11	0	40
K 12	*	320
K 13	*	1840
K 14	*	400
L 4	0	0
L 5	0	0
L 6	0	0
L 7	40	320
L 8	0	40
L 9	0	0
L 10	0	0
L 11	40	120
L 12	1080	40
L 13	*	1680
L 14	*	2080
M 4	0	0
M 5	40	0
M 6	0	0
M 7	0	0
M 8	0	0
M 9	0	0
M 10	0	0
M 11	80	0
M 12	120	0
M 13	*	960
M 14	*	3640
N 11	40	0
N 12	0	40
N 13	520	120
O 12	*	0
O 13	*	40

* = Grid point established in fall of 1987.

Table 7.--Rating of Stand Susceptibility by Grid Point. Catoctin Mountain Park Integrated Pest Management Activities, 1987 Activities.

Grid Point	Susceptibility Rating	Grid Point	Susceptibility Rating
C 3	1	J 7	3
C 4	1	J 8	1
D 2	2	J 9	1
D 3	2	J 10	1
D 4	1	J 11	2
E 1	*	J 12	2
E 2	1	K 4	1
E 3	2	K 5	3
E 4	1	K 6	3
E 5	3	K 7	2
F 1	1	K 8	2
F 2	1	K 9	1
F 3	1	K 10	2
F 4	2	K 11	3
F 5	3	K 12	2
F 6	*	K 13	*
F 7	*	K 14	*
F 8	1	L 4	1
G 2	3	L 5	1
G 3	1	L 6	2
G 4	1	L 7	2
G 5	1	L 8	2
G 6	*	L 9	1
G 7	2	L 10	3
G 8	1	L 11	2
H 2	1	L 12	3
H 3	1	L 13	2
H 4	1	L 14	*
H 5	1	M 4	1
H 6	*	M 5	1
H 7	1	M 6	1
H 8	2	M 7	1
I 2	1	M 8	1
I 3	1	M 9	1
I 4	1	M 10	1
I 5	2	M 11	2
I 6	3	M 12	2
I 8	2	M 13	3
I 9	2	M 14	*
I 10	1	N 11	2
I 11	1	N 12	3
J 2	2	N 13	2
J 3	1	O 12	*
J 4	1	O 13	*
J 5	1		

1 = Potential for light defoliation (0-20%)

2 = Potential for moderate defoliation (21-29%)

3 = Potential for heavy defoliation (30-100%)

* = Grid point established after risk rating was conducted.

Table 8.--Rating of Stand Vulnerability by Grid Point. Catoctin Mountain Park Integrated Pest Management Activities, 1987 Activities.

Grid Point	Vulnerability Rating	Grid Point	Vulnerability Rating
C 3	1	J 7	1
C 4	1	J 8	1
D 2	3	J 9	1
D 3	1	J 10	1
D 4	1	J 11	1
E 1	*	J 12	1
E 2	1	K 4	1
E 3	1	K 5	1
E 4	1	K 6	2
E 5	1	K 7	1
F 1	1	K 8	1
F 2	1	K 9	2
F 3	2	K 10	2
F 4	1	K 11	1
F 5	2	K 12	1
F 6	*	K 13	*
F 7	*	K 14	*
F 8	1	L 4	2
G 2	1	L 5	3
G 3	1	L 6	2
G 4	1	L 7	1
G 5	2	L 8	1
G 6	*	L 9	2
G 7	2	L 10	3
G 8	1	L 11	1
H 2	2	L 12	2
H 3	1	L 13	1
H 4	3	L 14	*
H 5	1	M 4	1
H 6	*	M 5	1
H 7	1	M 6	1
H 8	1	M 7	1
I 2	1	M 8	1
I 3	2	M 9	1
I 4	1	M 10	1
I 5	1	M 11	1
I 6	2	M 12	2
I 8	2	M 13	1
I 9	3	M 14	*
I 10	2	N 11	1
I 11	2	N 12	2
J 2	1	N 13	3
J 3	1	O 12	*
J 4	1	O 13	*
J 5	1		

1 = Potential for low mortality (0-10%)

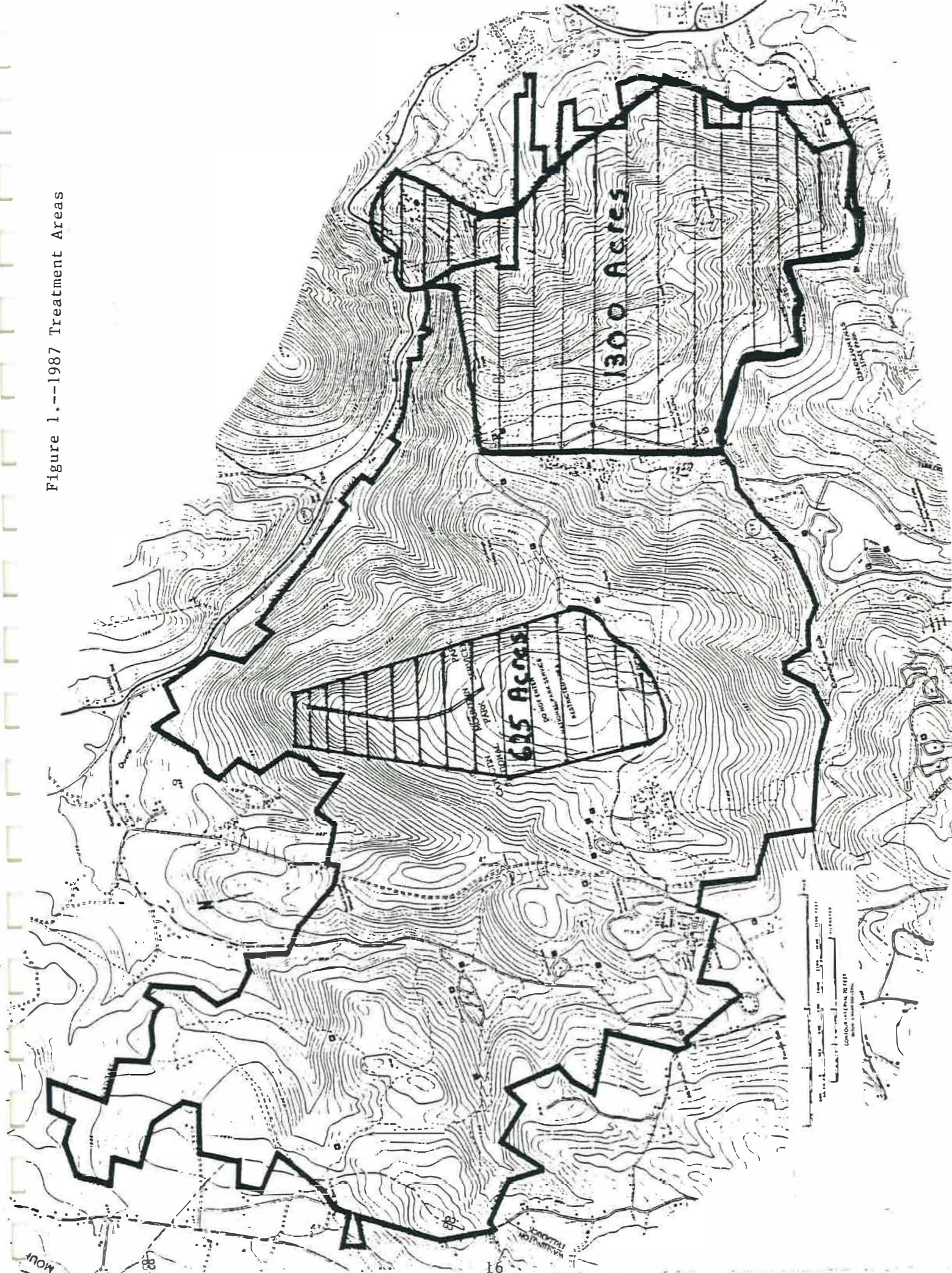
2 = Potential for moderate mortality (10-25%)

3 = Potential for high mortality (25-100%)

* = Grid point established after risk rating was conducted.

Figure 1.--1987 Treatment Areas

The map displays a topographic view of a mountainous landscape. Two specific treatment areas are highlighted with thick black outlines and diagonal hatching. The first area, located in the upper left, is labeled '615 Acres' and contains the text 'DO NOT ENTER' and 'NO PARKING'. The second area, located in the lower right, is labeled '1300 Acres'. The map features contour lines indicating elevation, a scale bar at the bottom, and a north arrow pointing towards the top right. Various geographical features and labels are visible throughout the map.



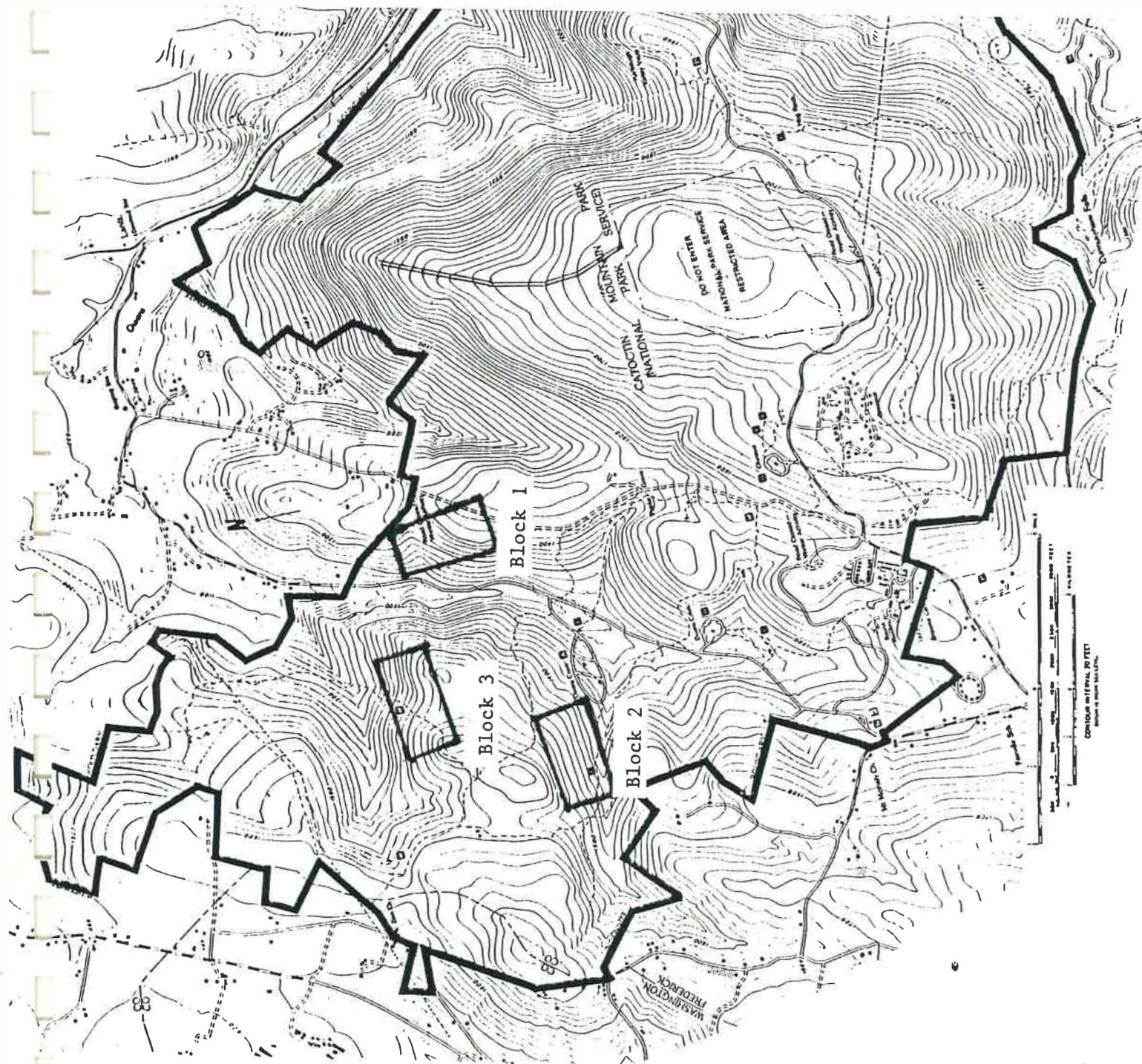


Figure 6.--Comparison of the Percentage of Plots Within Each Egg Mass Density Category, 1986 and 1987.

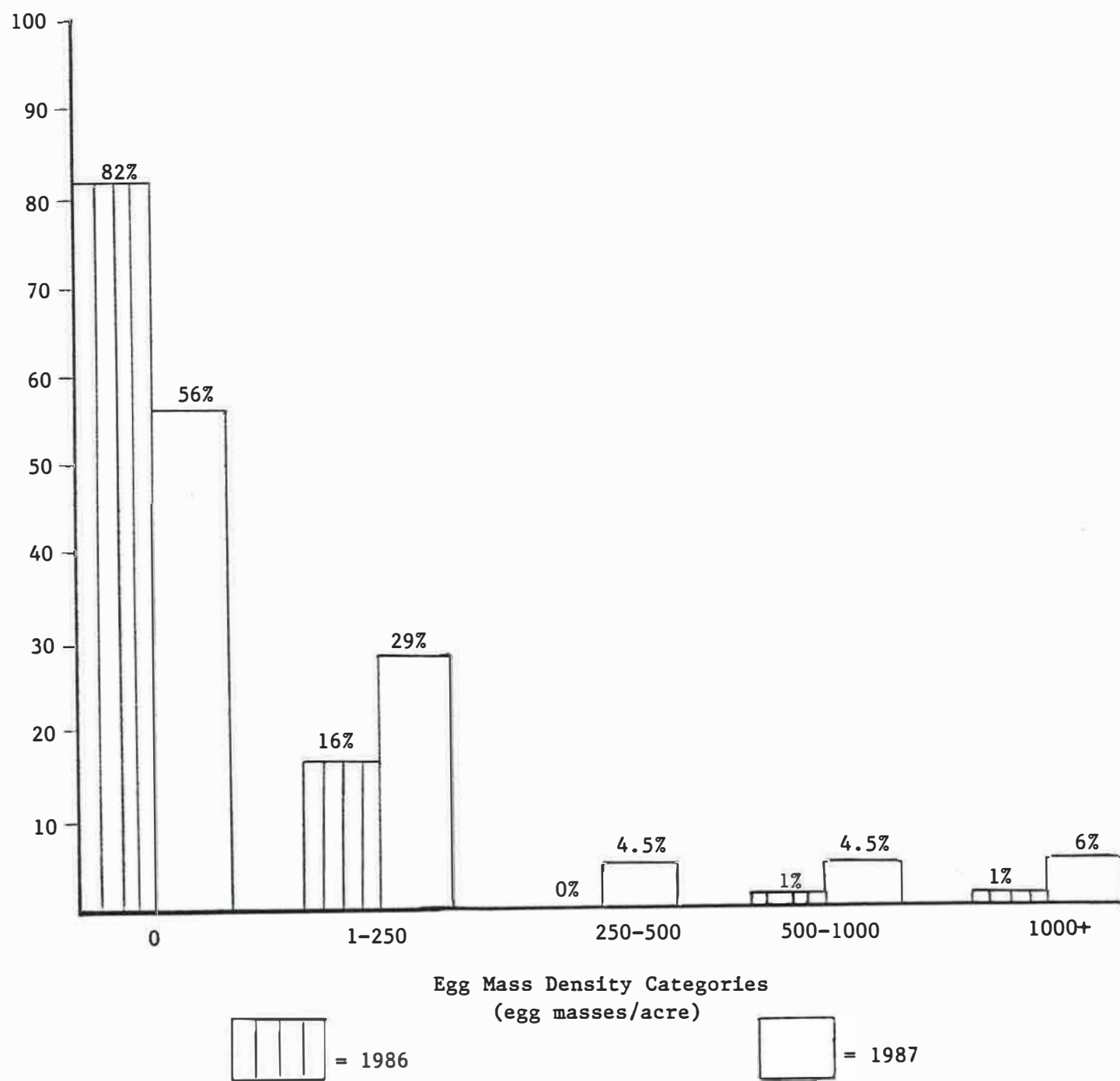


Figure 3. -- 1987 Gypsy Moth Defoliation
Results at Catoclin Mountain
Park

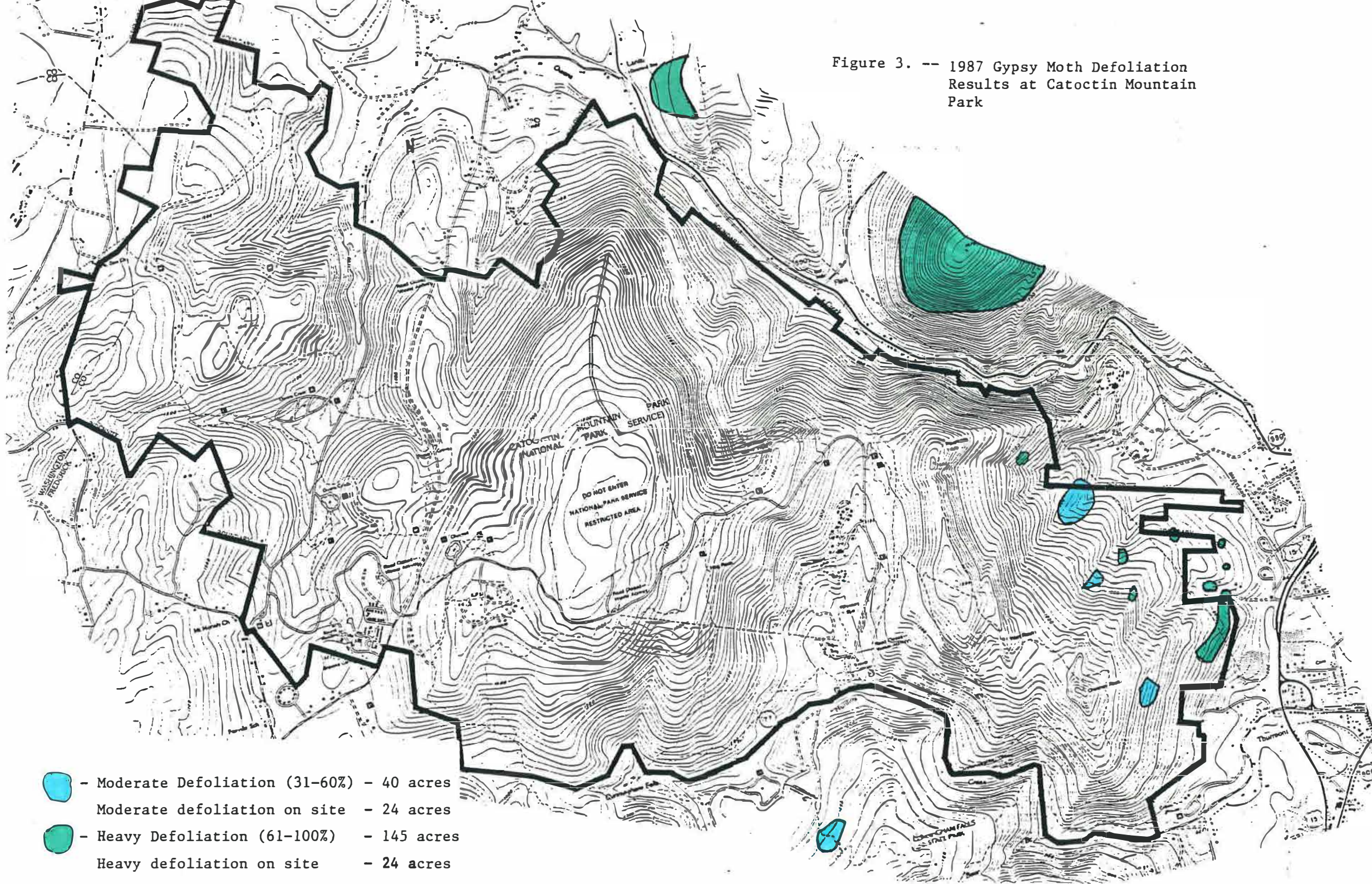


Figure 4.--Grid Point Locations and Male Moth Catches. Catoclin Mountain Park IPM Program, 1987 Activities.

N/A = New Grid Points. Established after the Male Moth Trapping Season.

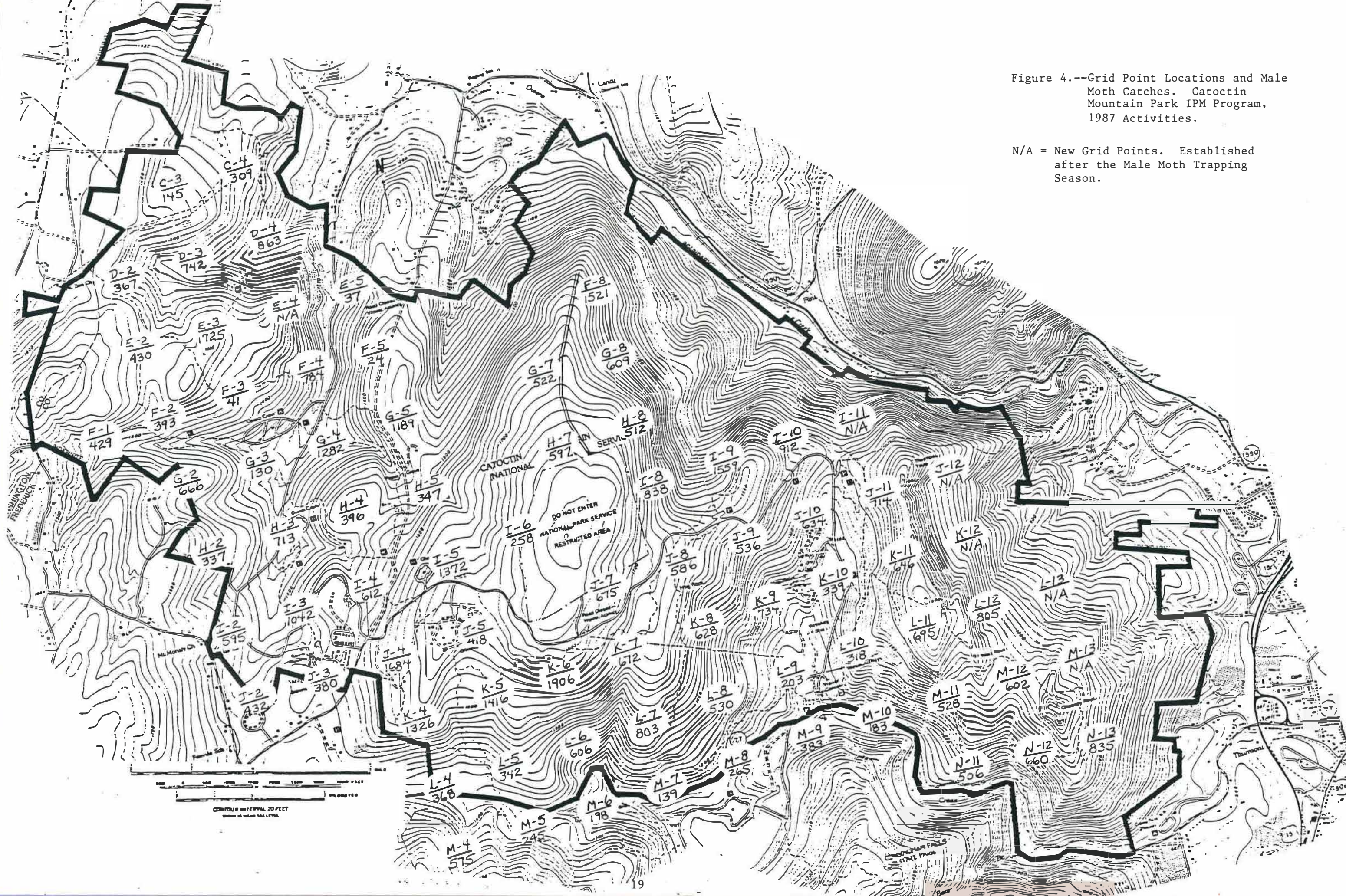


Figure 5.--Grid Point Locations and
Number of Egg Masses Per
Acre. Catoctin Mountain Park
IPM Program, 1987 Activities

